Catalyst Performance Comparison		
Reaction Conditions and Performance	Our Data (Table 5)	Literature data*
GHSV, h^{-1}	3750	180
T, ° C.	280	200
P, MPa	5.4 MPa	0.1
Catalyst	Rh—Mn/SiO_2	Rh_2MnO_4/SiO_2
CO Conversion, %	24.6	20.2
Selectivity		
CH_4	38.4	42.3
CO_2	0	3.0
MeOH	3.9	2.0
EtOH and C_2 Oxygenates	56.1	20.4
Other HCs	1.6	32.3

*S. Ishiguro, S. Ito, K. Kunimori, Catalysis Today 45, 197-201, 1998 (Table 1)

As can be seen, the use of a microchannel reactor allows us to operate at high throughput to achieve high conversion and improved selectivity.

TABLE 6

Performance Comparison of Structured Rh—Mn/SiO_2 Catalyst with Identical Powdered Form in a MicroChannel Reactor

	Run numbers	
	Run EC-02	Run ET 32
Catalyst Configuration	Rh—Mn/SiO_2 coated on FeCrAlY felt	Powdered Rh—Mn/SiO_2
GHSV, h^{-1}	20,000	2700
Conversion, mol %	20.4	22.7
Selectivity, %		
CH_4	36.5	31.1
CO_2	2.3	4.7
C_2^+HCs	3.2	1.7
Alcohols and C_2^+Oxy	58.0	62.4
Specific Activity, mmolCO Converted/g · h	46.0	26.8

H_2/CO = 1:1, T = 300° C.

We claim:

1. A method of synthesizing alcohols from CO or CO_2 comprising:

flowing a reactant gas mixture comprising H_2 and CO or CO_2 into contact with a catalyst;

wherein the catalyst comprises a Pd—Zn alloy dispersed on alumina; and

forming an alcohol or alcohols.

2. The method of claim **1** wherein the alcohol or alcohols formed in the step of forming an alcohol or alcohols consists essentially of methanol.

3. The method of claim **1** wherein the catalyst further comprises a Fisher-Tropsch catalyst and wherein the alcohol or alcohols formed in the step of forming an alcohol or alcohols comprises higher alcohols that contain 2 or more carbon atoms.

4. The method of claim **3** wherein the alcohol or alcohols formed in the step of forming an alcohol or alcohols comprises a mixture of alcohols in which ethanol is the principle alcohol.

5. The method of claim **3** wherein the catalyst comprises the Pd—Zn alloy dispersed on alumina catalyst and a Fisher-Tropsch catalyst that are mixed together.

6. The method of claim **3** wherein the catalyst comprises a first section that consists essentially of the Pd—Zn alloy dispersed on alumina catalyst, and a second section that comprises the Fisher-Tropsch catalyst.

7. The method of claim **3** wherein said step of flowing is controlled so that the contact time is less than 1 second.

8. The method of claim **7** wherein the catalyst is disposed in a reaction channel having a width of 5 mm or less, and further wherein the temperature variation across the catalyst is 10° C. or less.

9. The method of claim **6** wherein the first section and the second section are disposed in a reaction channel having a width of 5 mm or less.

10. The method of claim **6** wherein the reactant gas mixture contacts the first section before contacting the second section.

11. The method of claim **1** wherein the catalyst comprises crystalline ZnO.

12. The method of claim **2** wherein the reactant gas mixture comprises CO, and CO reacts with H_2 to form methanol.

13. The method of claim **1** wherein the reactant gas mixture comprises CO and CO_2.

14. The method of claim **1** wherein the reactant gas mixture consists essentially of CO and H_2.

15. A method of synthesizing ethanol or higher alcohols from CO_2 comprising:

flowing a reactant gas mixture comprising CO_2 and H_2 into contact with a catalyst;

wherein the catalyst comprises: (a) Pd—Zn alloy dispersed on alumina and (b) a Fischer-Tropsch catalyst; and

forming ethanol or higher alcohols.

16. A method of synthesizing an alcohol comprising:

contacting hydrogen and CO over an alcohol catalyst in a microchannel;

removing heat into a heat exchanger; and

converting at least 20% of the CO into products with a selectivity to C_2^+ oxygenates of at least 30%.

17. The method of claim **16** comprising a selectivity to ethanol of at least 30%.

18. The method of claim **16** wherein the catalyst is disposed in a flow-by configuration in the microchannel.

19. The method of claim **16** wherein the catalyst comprises an alcohol synthesis catalyst and a Fischer-Tropsch catalyst.

20. The method of claim **19** wherein the alcohol synthesis catalyst and Fischer-Tropsch catalyst are mixed together.

21. The method of claim **19** wherein the alcohol synthesis catalyst and Fischer-Tropsch catalyst are sequentially arranged in the microchannel.

22. The method of claim **16** wherein the catalyst comprises Rh and Mn disposed on silica, titania, or zirconia.

23. The method of claim **22** wherein the catalyst is disposed on a large pore support and wherein the catalyst on the large pore support has a pore volume in which at least 20% of the pore volume is composed of pores in the size range of 0.1 to 300 microns.

24. The method of claim **16** wherein temperature is maintained at less than about 270° C.

25. The method of claim **22** wherein temperature is maintained at less than about 270° C.

26. The method of claim **16** wherein and comprising passing reactants through the microchannel at a gas hourly space velocity of at least 3000 h^{-1} and converting at least 20% of the CO into products with a selectivity to C_2^+ oxygenates of at least 40%.

27. The method of claim **18** wherein and comprising passing reactants through the microchannel at a gas hourly space velocity of at least 3000 h^{-1}.